

## Short Communication

# Serum malondialdehyde levels during menstrual cycle

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**Oxidative stress theory has been investigated to explain the pathological basis of many medical conditions. This study is thus aimed at examining the oxidative stress pattern during the different phases of physiological phenomenon of menstruation in-relation to the hormonal characteristics. Venous samples from the cubital vein was taken from 25 apparently well female subjects after a 12 hour overnight fasting during the three phases of their menstrual cycle. Serum Malondialdehyde (MDA) activity was assayed in all the samples. There was no statistical difference between the mean values of MDA during the follicular and the ovulatory phase of menstruation. However, MDA level in the luteal phase was significantly different from the MDA levels during follicular and ovulatory phases. ( $p < 0.05$ ). Serum Malondialdehyde level significant increase coincided with the increase progesterone and estrogen levels during the luteal phase of menstruation which is characterized by foci and coalase necrosis. This may support the fact that oxidative stress theory has an important role to play in the physiological phenomenon of menstruation**

**Key words:** Serum malondialdehyde, menstrual cycle.

## INTRODUCTION

The cyclic hormonal activity that led to functional and structural changes in the ovary, uterus and cervix in normal menstrual cycle is a complex interplay of the activities of the sex hormones under the influence of the higher centres hormones from the hypothalamus and the anterior pituitary glands through a negative feedback mechanism (Whitley et al., 1992). The normal menstrual cycle is a twenty eight day period characterised by three phases namely follicular, ovulatory and luteal phases. The follicular phase is characterised by a low level of estrogen, while during the ovulatory phase, there is a rise in estradiol, lutenizing hormone (LH), and follicle stimulating hormone (FSH). The last phase is characterised by increased progesterone and estrogen. The ovulatory and luteal phases have been of particular attention in some young adult ladies because of its close association with pain and discomfort (dysmenorrhoea) (Whitley et al., 1992). Dysmenorrhoea has been attributed

to the increased accumulation or extra sensitivity of the body to prostaglandins which causes spasm of the uterine muscles. Probably 50% of women complain of dysmenorrhoea at some stage of their life usually between 17 and 25 years (Llewellyn-Jones, 1986).

Several powerful oxidants are produced during the course of metabolism in blood cells and most other cells of the body. These oxidants are very reactive molecules that can react with proteins, nucleic acids, lipids and other molecules which changes physicochemical status of the cell to alter their structure and cause tissue damage. Lipid peroxidation is a well established mechanism of cellular injury in human and is used as an indicator of oxidative stress in cells and tissues. Lipid peroxides derived from polyunsaturated fatty acids are unstable and can be decomposed to form a complex series of compounds. These include reactive carbonyl compound, which is the most abundant malondialdehyde (MDA). The measurement of MDA is widely used as an indicator of lipid peroxidation and increased levels of the peroxidation products have been associated with a variety of acute, chronic pathophysiological processes in the human as well as animal models (Killic et al., 2003).

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This study is thus aimed at examining oxidative stress pattern during the different phases of normal menstruation relating such to the hormonal characteristics.

## MATERIALS AND METHODS

This is an explorative study of MDA activity in twenty five (25) female students of the University of Ilorin aged between 18 and 26 years (mean  $21.04 \pm 2.0$  years) serum MDA level was assayed during their monthly menstrual cycle. All subjects were not obese, nor on any medication of any known pathologies. Venous samples from the cubital vein was taken from the subjects after a 12 hour overnight fast during the three phases of their menstrual cycle after an informed consent. The subjects acted as self control. Sera were harvested and stored at  $-20^{\circ}\text{C}$  until the time of analysis.

The MDA levels were measured by the double heating method (Stocks and Dormandy, 1971). The principle of the method was based on the spectrophotometric measurement of the colour developed during the reaction of thiobarbituric acid with MDA. The concentration of thiobarbituric acid reactive substances was calculated by the absorbance coefficient of malondialdehyde-thiobarbituric acid complex.

The data obtained was subjected to statistical analysis using the EPI-INFO 2000 statistical package. The comparison of continuous variables was done using the Student t test while probability value of  $p < 0.05$  indicated a statistically significant difference.

**Table 1.** Serum MDA levels during menstruation.

Phase	Follicular	Ovulatory	Luteal
Mean MDA Level	0.18	0.18	0.75
+ SD	0.13	0.04	0.21

## RESULTS AND DISCUSSION

The mean serum MDA level during the three phases of menstruation is as presented in Table 1. The mean serum MDA level was  $0.75 \pm 0.21$  nmol/L during the luteal phase and  $0.18 \pm 0.04$  nmol/L during the ovulatory phase. The difference between MDA levels in the luteal phase was significantly less ( $p < 0.05$ ) when compared with the follicular and ovulatory phases.

This study has demonstrated the significant relationship between the oxidative stress theory and sex hormones in females during the physiological phenomenon of menstruation. The significant rise of MDA during the luteal phase of menstruation coincides with the increased level of estrogen and progesterone, which is characteristic of this phase when the granulosa and theca cells of the follicle lining promptly began to proliferate to form the corpus luteum which is yellowish lipid-rich (Ganong, 1987). Previous literature has attributed the proliferative bulky uterus to be under the influence of both estrogen and progesterone while the sloughing of the endometrium is mainly due to increased

estrogen from the developing follicle (Whitley et al., 1992; Llewellyn-Jones, 1986; Ganong, 1987). With the regression of the hormonal support for the endometrium, foci and later coalase of necrosis appears eventually leading to menstrual flow (Ganong, 1987).

The exact relationship between the MDA and estrogen levels may not be certain. The high estrogen level from developing follicles may be the initiator of lipid peroxidation process which eventually ends up with foci and coalase necrosis. Cell injury causes the release of cytokines especially tumour necrosis factor alpha, which generates reactive oxygen species from the tissues which in turn causes lipid peroxidation (Romero et al., 1998). The generated superoxides may play an important role in spam of the highly vascularised vessels leading to vascular necrosis and menstrual flow. The spam and necrosed endometrial vessels may thus be responsible for the large quantity of prostagladins (PGF $2\alpha$ ) which has been reported to play a role in dysmenorrhea (Llewellyn-Jones, 1986).

One theory of menstruation onset suggests that the release of lysosomal enzymes form necrotic endometrium foster the formation of prostagladins from cellular phospholipids via a free radical generating process (Ganong, 1987). These generation free radicals which have also been implicated in a number of pathologies including dysmenorrhea (Llewellyn-Jones, 1986), atherosclerosis (Steinberg, 1997), cancer (Cerutti, 1994), hypertension (Sagar et al., 1992), obesity (Olusi, 2002) and other chronic illness (Killic et al., 2003; Egwunyenga et al., 2004). This study perhaps therefore suggests that the high MDA level in the luteal phase may play an important role in the initiation of menstration which is a well established cellular injury based phenomenon.

In conclusion, the process of lipid peroxidation in the physiological phenomenon of menstruation is demonstrated by the relationship of the high lipid peroxidation product (MDA) and the characteristic high level of estrogen during the luteal phases. The secertory phase of the endometrium currently been investigated by endometrial biopsy may give way to a biochemical indicator which is not invasive, reliable and time saving. However, a larger study may be needed to establish its clinical indicative usefulness.

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